THE

HISTORY AND CONSTRUCTION

OF

THE MAIN SEWERAGE PUMPING STATION AT

THE FOOT OF NEW JERSEY AVE.

WASHINGTON, D. C.

THESIS PREPARED AS INITIATION REQUIREMENT TO TAU BETA PI ASSOCIATION

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ABSTRACT

As a part of the development of the plan set forth by the Board of Sanitary Engineers in July 1890, a sewage pumping station was erected at the foot of New Jersey Avenue for the purpose of pumping sewage drained there to a sufficient height to force it thru an inverted siphon under the Anacostia River to the outfall sewer. The station was built from 1903 to 1908 at a cost of $1,217,020 under the direction of Asa E. Phillips.

The sanitary sewage drained there is run thru a sediment basin and a set of screens to remove solid matter. It is then raised by centrifugal pumps about 17 feet into the siphon head chamber, whence it goes thru the siphon. The sewage from the low area of the city is handled separately. The storm water is raised by another set of pumps and discharged into the river. The engines for driving the sanitary and storm water pumps are Allis-Chalmers triple expansion and double expansion, self condensing, corliss valve engines, respectively. Steam is generated by six 293 HP Babcock & Wilcox boilers equipped with Rooney stokers.

Due to obsolescence of old equipment, new pumps, electric motors, and screening apparatus is being installed. The pumps, with increased capacity, will be operated by 2300 volt synchronous motors. Current will be purchased from PEPCO.

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-INTRODUCTION-

The city of Washington until the year 1850 was a rather unpretentious and undeveloped town with poor municipal facilities, increasing in size at a rate of from four to nine thousand persons per decade. However, due to increased governmental activity stimulated chiefly by the Civil War, the population took a sudden upturn, standing at 51,000 in 1850, 75,000 in 1860, and 131,000 in 1870. Because of this rapid development, a Board of Public Works was formed in 1871, and among other municipal improvements, construction of a sewerage system was begun. Sewers were planned and built to meet the drainage requirements of that time without provision being made for future extension or development. Due to this lack of foresight, a dangerous nuisance was created by the accumulation of sewage in the populated sections of the city. No proper disposal system was provided. All sewerage was discharged directly into various small streams and canals within the city. Mr. D. E. McComb, Superintendent of Sewer Department, in his annual report for 1887 stated that interception of the main sewers and conveyance of the sewerage to deep water was a necessity. The pollution of the James Creek Canal,

the 17th Street Canal, and Rock Creek had created a dangerous situation which was a health menace and had become a constant source of complaint.

To remedy this condition, and in the interest of public health, an act of Congress on March 2, 1889 authorized the President of the United States to appoint a board of 3 competent sanitary engineers to design and report upon a suitable sewerage system for the city. Frederic P. Stearns, Rudolph Hering, and Samuel Gray, who were appointed to this board in August 1889, made an exhaustive study of the requirements, and in July 1890 presented comprehensive plans and recommendations for a system of interceptors, a pumping station, an outfall sewer, and for dikes about the low area of the city. On these plans, the city's present sewerage and sewage disposal system is largely based.

THE SEWERAGE SYSTEM AND THE SEWAGE DISPOSAL SYSTEM

It is felt that a brief summary of the sewerage and sewage disposal systems would not be amiss here in order to give a clear picture of the relation of the pumping station to the rest of the system. The term "sewerage system" refers to the system of piping draining by gravity the refuse water of the city into larger and larger trunk sewers. A standard section of pipe sewer is shown in Figure 1. The term "sewage disposal system" refers to the interceptors or large conduits which intercept the trunk sewers, the pumping station, the outfall sewer and the treatment plant at Blue Plains.

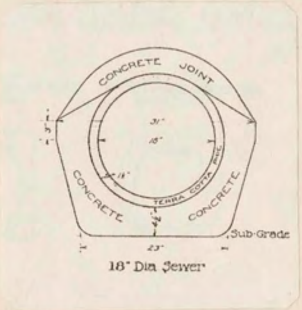

Fig. 1

Typical section of pipe sewer.

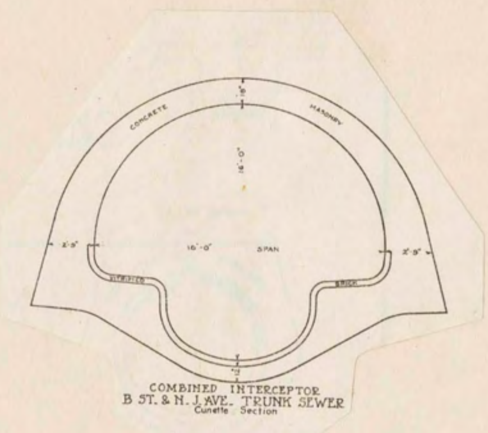

Fig. 2

Typical section of an interceptor. Cunette section is shown in the lower part.

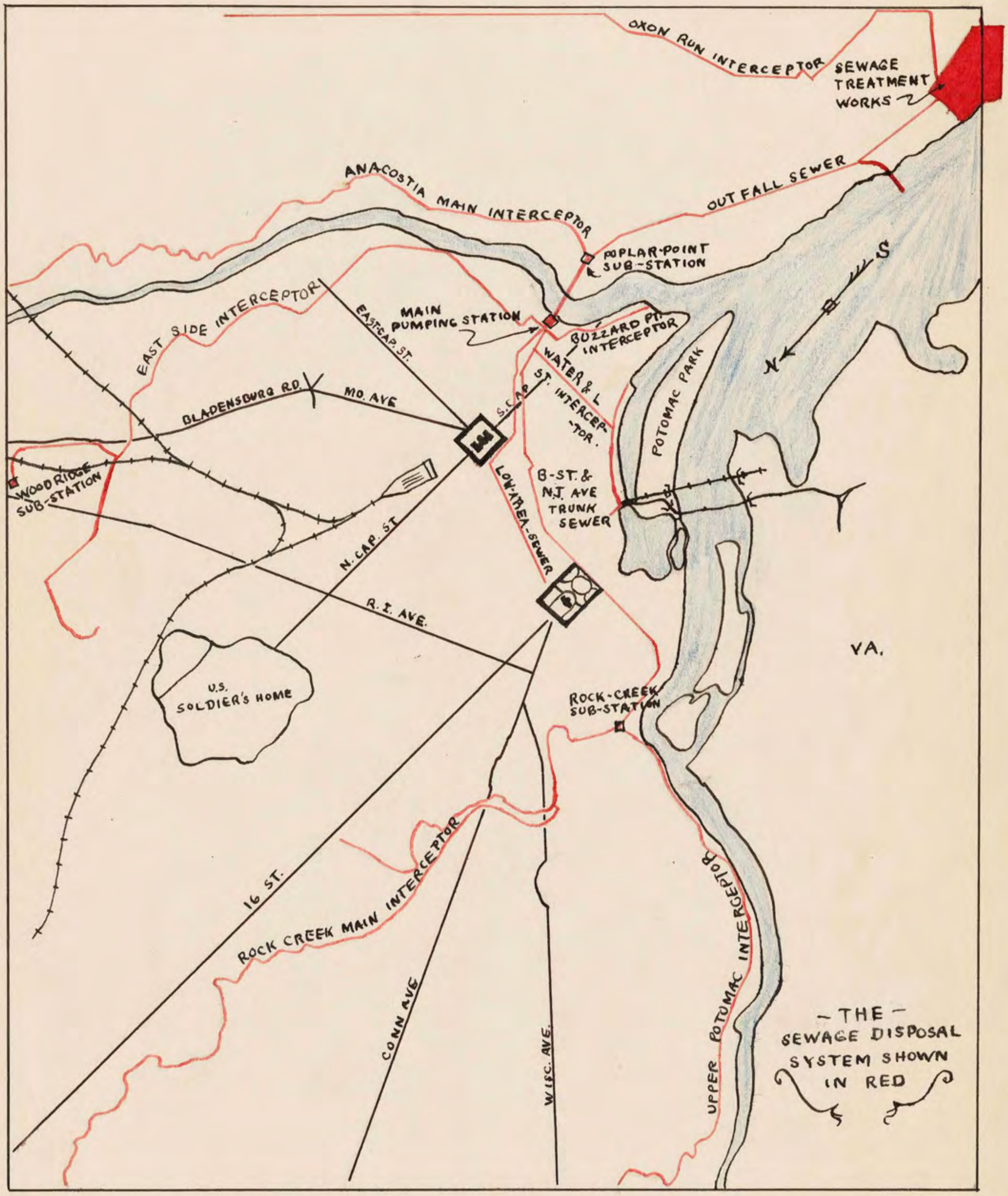

Fig. 3

Map of the District of Columbia showing the sewage disposal system (in red).

The present sewerage system is essentially made up of combined system sewers carrying both sanitary and storm water drainage in the older sections, while in the newer outlying sections, the policy is to construct separate systems for sanitary and storm water. The sewerage flows into large gravity interceptors which are laid in the thread of the large valleys in the District. The interceptors, a typical section of which is shown in Figure 2, connect and deliver substantially the entire sewage of the District to the pumping station. The main sewerage pumping station is located at 2nd and N Streets, S. E., at the end of New Jersey Avenue on the Anacostia River, at a point where the most satisfactory crossing could be obtained, as well as at a point convenient for connection from the interceptors. Four substations lift sewerage from low points in the city into the interceptors. The Anacostia sewage is delivered with the aid of eight substations to the Poplar Point Station, where it is discharged into the outfall sewer on the south side of the river. From the pumping station, the sewage passes thru an inverted siphon under the river, thru the outfall sewer to the Potomac River directly, or to the treatment plant at Blue Plains. After treatment, it is discharged at a point about opposite Alexandria, Virginia. The positions of these points are shown in Figure 3.

HISTORY OF THE STATION

The Superintendent of the Sewer Department, Mr. McComb, in his report of 1887, as mentioned above, strongly recommended the

construction of interceptors to carry off sewage to deep water away from the center of population. In February 1890, he recommended the construction of a pumping station to pump out sewage and storm water from the low area, this area being roughly that south of E Street and west of the Capitol, which is below the level of the river when it is at flood stage. This is the first mention found regarding a pumping station. The Board of Sanitary Engineers, in their report in July 1890, included the construction of a pumping station, the purpose of which would be to lift sewage drained there in the interceptors up to a sufficient height to force it thru a siphon over to the outfall sewer, and also to pump storm water into the river.

In 1893, the first appropriation for the system planned by the Board, of $190,000, was made. This was for construction of the Easby Point Interceptor. In the following decade, in the development of the system, many more interceptors were authorized and construction started. Altho not a part of the pumping station, they are such an important adjunct to it, that mention of them should be made. The following interceptors were authorized by Congress:

1893-Easby Point Interceptor
1896-Rock Creek and B Street Interceptor
1898-Tiber Creek and New Jersey Ave. Interceptor
1900-Boundary sewer and east side Interceptor
1902-Low Area trunk sewer
1904-Outfall sewer and siphon
1905-Water and L Streets Interceptor
1905-4½ Street Interceptor

In the meantime, the advent of the pumping station was slowly approaching. In 1899, an appropriation for land and preparation of plans was made. Asa E. Phillips was engaged as

chief engineer in charge, and under his hand was developed an ingenious and foolproof pumping station which today takes care of a city over twice the size of Washington at that time. The careful planning and great foresight used is evidence of the engineering abilities of Asa E. Phillips. In 1901, the first appropriation for construction was made. Messrs. Didden and Voight were engaged as architects for designing the building proper. At this time, Major John Biddle, Corps of Eng'r, U. S. Army, was Engineer Commissioner of the District. The substructure of the plant was built by contracts with eight different companies, at a cost of $539,820, chief among which was the Ambrose B. Stannard Co. The substructure includes the foundation, the sea wall, the piers upon which the building rests, the coffer dams, the cast iron suction and discharge mains, and the sediment basin.

The superstructure, consisting of the building housing the equipment and the supporting members for the engines, was constructed by the Ambrose B. Stannard Co. and the American Bridge Co. at a total cost of $310,000.

The equipment, including the engines, pumps, boilers, screens, sluice gates, elevator, crane, coal handling mechanisms, recording and metering apparatus, etc., was installed by nine companies, with whom contracts were made at a total outlay of $367,000.

Five years were required to consummate the building of the station. In the meantime, work had progressed on the various interceptors and was completed at approximately the same time. The plant was put into operation by 1908.

Since this time, little change has been made in the station

up to the present. The paving and improving of the water-front area behind the station was accomplished in 1932, along with the construction of a garage. This construction required about eight months. The garage, like the station, is set on piers for support, the saturated condition of the earth preventing any other method. After 1930 or 1931, trucks were used to bring coal to the plant, instead of barges. Therefore, in 1933, the old crane equipment for carrying coal from the barges to the bunkers was removed.

The equipment of the plant was given a rated life of 25 years. This equipment, after giving 30 years of dependable service, was becoming worn, inefficient, and expensive to operate. Therefore, specifications for a complete rehabilitation of the plant were drawn up. Money was obtained from PWA funds, and on July 28, 1937, reconstruction was started. The new electrically-operated equipment, including pumps, improved type screens, solid matter disposal equipment, reserve emergency equipment, and metering apparatus, has a total estimated cost of $567,766, and is being installed by the Suburban Engineering Co. of New York City. The installation will be completed by July 11, 1938. This rehabilitation again brings the station up to date, making it modern and efficient in every respect, and giving it increased capacity to handle the city's sewage up to a total population of much greater than exists at present.

CONSTRUCTION AND OPERATION

GENERAL:

In designing the pumping station, it was deemed advisable

Fig. 4

View of the station from N street.

Fig. 5

View of the station along 2nd street, showing stack in the rear.

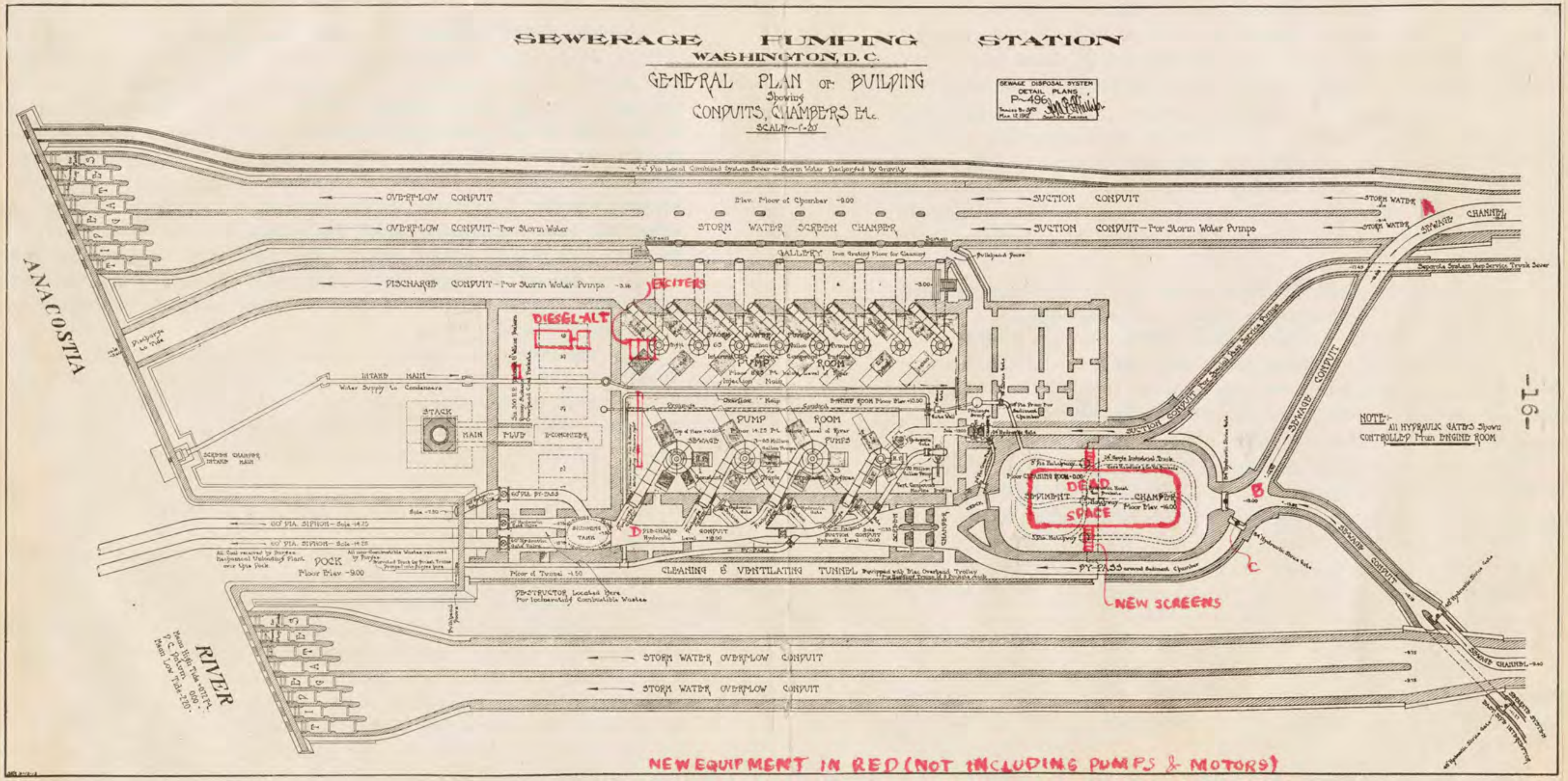
SEWERAGE PUMPING STATION
WASHINGTON, D. C.
GENERAL PLAN OF BUILDING
Showing
CONDUITS, CHAMBERS Etc.
SEWAGE DISPOSAL SYSTEM
DETAIL PLANS
P-496
ANACOSTIA
RIVER
OVERFLOW CONDUIT
OVERFLOW CONDUIT—For Storm Water
STORM WATER SCREEN CHAMBER
SUCTION CONDUIT
SUCTION CONDUIT—For Storm Water Pumps
GALLERY
DISCHARGE CONDUIT—For Storm Water Pumps
EXCITERS
DIESEL-ALT
PUMP ROOM
STACK
INTAKE MAIN
SEWAGE PUMPS
DISCHARGE CONDUIT
SUCTION CONDUIT
DEAD SPACE
CHAMBER
DOCK
CLEANING & VENTILATING TUNNEL
BY-PASS
NEW SCREENS
SEWAGE CONDUIT
SEWAGE CHANNEL
STORM WATER
STORM WATER OVERFLOW CONDUIT
NOTE:- All HYDRAULIC GATES Shown CONTROLLED From ENGINE ROOM
A
B
C
D
NEW EQUIPMENT IN RED (NOT INCLUDING PUMPS & MOTORS)

FIGURE-6

to consider the building simply as a shelter for the machinery, and not as an enclosure for the entire plant. Therefore, the equipment for **handling** the sewage was first designed by Mr. Phillips. Following this, the architects designed the building to house the boiler, engines, shops, and offices, much of the substructure being without the confines of the building walls. The substructure occupies an area about 200 X 700 feet. The building, 138 X 300 feet, is located at about the center of this space. This is indicated in Figure 6.

As mentioned before, the station is so designed as to be practically foolproof. The course of the sewage thruout the station is provided with by-passes at several points, so that in case of failure of any part of the station, the sewage may be by-passed, thus eliminating the danger of backing up.

PATH OF THE SANITARY SEWAGE THRU THE STATION:

The interceptors have combined into two main channels by the time they have reached the station (not including the Low Area sewer). The sanitary sewage flows in the cunette section of the interceptor (See Figure 2.). As the conduit reaches the station, the cunette section sweeps away at point A in Figure 6 from the main body of the interceptor and runs into the junction point at the head of the sediment chamber. The level of the cunette on the west side is -13.44'. This figure, as well as others mentioned in this paper in regard to elevation, is based on 0 as the mean tide level at Washington. The level of the remainder of the conduit is -9.14'. This gives the effect of a 4-foot dam to the storm water suction conduit. During time of storm, water over this 4-foot level flows into the storm water screen

chamber. If it flows high enough, it will discharge by gravity into the river thru the tidal gates. Otherwise it is handled by the storm water pumps. From the above, it will be seen that the storm and sanitary sewage have a common carrier, but due to the design, sanitary sewerage is ordinarily diverted away. Of course, during a storm, when a sudden large volume of water is handled, most of the water goes to the storm pumps, and sanitary sewage is naturally mixed in with this. However, owing to the greater density of sanitary sewage due to suspended solid matter, it tends to remain at the bottom of the stream and is still diverted from the remainder of the water. The two main sanitary sewage streams converging at the entrance to the sediment chamber are admitted thru an 84" hydraulically operated sluice gate. The rate of flow at this point is about 1/5 foot per second. This gate is shown in Figure 7. In case the sediment chamber is inoperative, the water may be admitted thru a similar valve (shown at C in Figure 6) into a by-pass around the sediment chamber. If the entire sanitary side of the station were inoperative, the sewage could all be disposed of thru the storm conduits. As a matter of fact, at the time of writing, just that is being done, as the sanitary sewage pumps are in process of replacement.

Upon entering the sediment chamber, a room 50 X 104' in size, the sewage loses its velocity. Most suspended matter which would sink is here deposited. About eight times a year, the sewage is by-passed, and an average of 300 tons of silt removed from the floor and deposited in lowlands below the city limits. The floor of this chamber is at an average elevation of -16'.

Figure. 7

84" Sluice gate at entrance to sediment chamber.

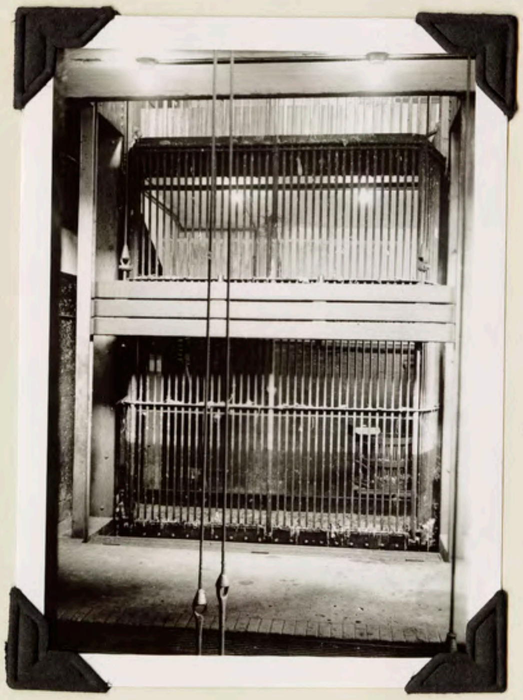

Fig. 8

One of the screens elevated for cleaning. Cables supporting another screen can be seen in foreground.

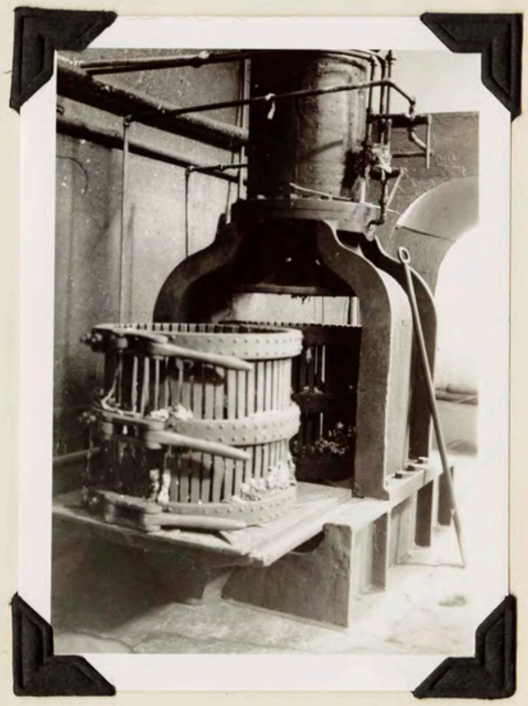

Fig. 9

Hydraulic press for compressing and drying refuse matter.

Fig. 10
65,000,000 g.p.d. centrifugal pump for sanitary sewage.

Fig. 11
Siphon chamber showing entrance to twin mains of the inverted siphon.

From the sediment chamber, the sewage flows thru the screen chamber. Here are four screens, 9' X 10' in size, which collect all floating matter remaining. At least one of the screens of each tandem set of two is always down. The other one is raised alternately with it every half hour by a hydraulic ram. Figure 8 shows the screen chamber with one screen raised. Here the collected refuse is scraped off with pitchforks and placed in the hydraulic press shown in Figure 9. This press expels water from the screenings which are then burned in a water-jacketed incinerator. Numerous strange objects find their way into the sewerage to be picked up on these screens. For example, lumber measuring as large as a 4-foot length of 12 X 12, 2 X 4's, etc. have been removed. Any object which happens to get thru both the sediment chamber and the screen chamber can usually also pass the pumps and be discharged.

After passing the screen chamber, the sewage enters the cast iron suction mains and is drawn into the centrifugal pumps, one of which is shown in Figure 10. These impel the fluid up thru the discharge conduits towards the siphon chamber.

There are three centrifugal pumps, each with a capacity of 6000 cubic feet per minute, or 65,000,000 gallons per day (g.p.d.), handling main sanitary sewage. They are at the bottom of the lift; that is, they push the water up thru the discharge mains. The suction inlets are 66" in diameter where they leave the main conduit and 50" at the pump. The discharge main expands from 54" at the pump to 66" again at the check valve, where the sewage flows into the main discharge conduit. The pumps on the average lift the sewage about 17 to 19 feet with a

possible maximum of 27 feet in case sewage is discharged into the Anacostia instead of the outfall sewer. The pumps' casings are about 16 feet in diameter with an 8' 6" impeller revolving around 100 rpm. The sewage is now at a point indicated by D in Figure 6, at a level of 18 feet. From here it is impelled to the siphon chamber. This is a large square well and is shown in Figure 11. Here the water rises, due to the force of the pumps, to sufficient height to force the water thru the siphons to the outfall sewer across the river. The entrances to the twin siphons, each 5' in diameter, can be faintly seen at the bottom of the well. A 5' by-pass is also provided for passing water directly to the river.

Thus have we followed the path of the sanitary sewage thru the station.

THE LOW AREA SYSTEM

The Low Area has been previously mentioned. The sanitary sewage from the deep basements of this area is carried by a separate carrier, the Low Area Trunk Sewer, directly to the pumping station, where it is handled entirely independently of the other sewage. The sewage goes thru a small screen chamber of its own; and it is then pumped by a centrifugal pump, lifting about 20 to 22 feet, similar in design to the other three sanitary pumps, except for size. It is a 20,000,000 g.p.d. pump (1920 c.f.m.) with a discharge opening of 48". The discharge is normally emptied into the main discharge conduit, but may be by-passed and discharged separately into the river.

STORM WATER

When storm water flows thru the storm water suction conduits, it flows into the storm water screen chamber pictured in Figure 12. Here it flows thru screen placed all along the east side of the chamber under the gallery from which the picture was taken. The suction inlets of the pumps receive the water and the pumps raise it from 3½ to 5 feet thru 66" discharge mains to the discharge conduit, the floor of which is at a level of -3. The discharge opening to the river of this conduit may be seen in Figure 13 as the large arched opening to the right in the sea wall. The many rectangular openings are the tidal gates on the overflow conduits (See also Figure 6.). As many of the pumps are brought into use as the volume being handled requires. The plant is designed for carrying the heaviest storm to occur on the average in 12 years, so that it is very seldom that all the pumps are used. It might be mentioned here also that much storm water in the city is diverted at other points and never reaches the station. Float gates at 27th and G Streets divert much water directly to the Potomac River.

THE ENGINES

Each sanitary pump is operated by an Allis-Chalmers, triple-expansion, self-condensing, corliss valve engine placed directly over the pump on the engine room floor, which is the ground floor of the building. The eight storm water pumps are likewise operated by Allis-Chalmers, double expansion, self-con-

Figure 14

General view of engine room showing sanitary sewage engines. 20 million g.p.d. pump in foreground. Note tail rod which operates condenser pump.

Figure 15

General view of engine room.

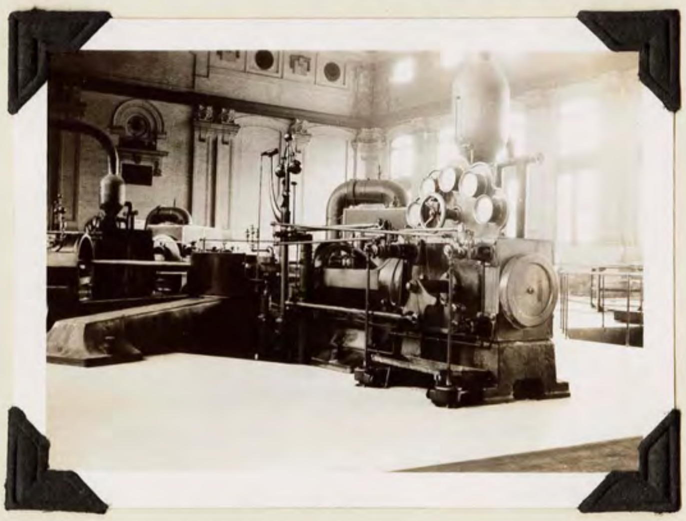

Figure 16

Close view of engine operating 65,000,000 g.p.d pump. Level gages may be seen on the wall near ceiling.

densing, corliss valve engines. A general view of the engine room is shown in Figures 14 and 15. The three cylinders of the engines for the sanitary pumps are placed at 120 degrees to each other, the connecting rods all working on a common crank pin and rotating the pump impeller shaft. Three of these engines are identical. A view of one of these is shown in Figure 16.

Operating figures on these engines are as follows:

	Pressure in psi abs.	Size of cylinder inches
Initial pressure, High press. cyl.	118	14 X 30
1st receiver, Intermed. cyl.	42	26 X 30
2nd receiver, Low press. cyl.	13	40 X 30
Back pressure in condenser	4 (varies)	

These pressures originally were considerably higher, running about 150 psi initial pressure when new. However, due to aging of the boilers, the operating pressure has several times been reduced. The engines have no given rated horsepower, but the figure runs around 300.

The engine operating the low area pump is similar in every respect except for size to the three main sanitary engines. Its operating pressures are the same. The h.p., i.p., and l.p. cylinders have diameters of 9", 16", and 24" respectively with a 24" throw.

The storm water pumps have engines having 2 cylinders mounted at 90 degrees to each other.

Figures on these engines follow:

	Pressure psi-abs.	Size of cylinder inches
Initial press. High press. cyl.	118	10 X 30
Receiver, Low press. cyl.	38	22 X 30
Condenser back pressure	4 (varies)	

Altho the pumps operated by these engines have the same capacity as the sanitary pumps, the engines needed are smaller, due to the much smaller lift necessary for the storm water. They are about 250 HP.

The valve mechanism on the engines is of an adapted Corliss type, only the exhaust valves being operated by the wrist plate. The inlet valves are operated by a separate rocker arm and connecting rod, to which is also attached the governing mechanism.

The condensers are operated by a reciprocating pump run by the tail rod of the engines. River water is used as the cooling medium. The steam coils are of copper. The engine is incapable of operating at atmospheric pressure, that is, without the condenser.

Each pump shaft is mounted on a large 4-plate brass and steel thrust bearing situated about half way between the engine and the pump. Two guide bearings are provided, one at the top, and a lignum-vitae wood and bronze one at the pump.

THE BOILERS

Steam is provided for the engines by three batteries of two Babcock and Wilcox water tube boilers rated at 293 HP each, burning Cumberland soft coal. These boilers, shown in Figure 17, receive the coal from overhead bunkers with a storage capacity of 1,800 tons. The coal is delivered thru the weighing chute to Rooney automatic mechanical stokers, which propel the fuel across an inclined grate by a rocking or jiggling motion.

Coal is now brought to the plant in trucks and dumped into a hopper, which discharges to a McCasslin bucket conveyor which carries the coal overhead to the coal bunkers. Originally, the coal arrived on barges and was hauled up by a bucket crane to an endless belt that carried the coal across to the bunkers. This old equipment is entirely dismantled.

The combustion gases formed are run thru a Green economizer which heats the boiler feedwater. The feedwater is treated by a Permutit water softener outfit and metered thru a venturi before entering the boiler. The steam was originally generated at about 150 psi., but at present at only a little over 100 psi.

Ashes are taken from the ash pit and removed from the plant thru the cleaning and ventilating tunnel, a low arched tunnel running the length of the building at an elevation of -1.5'. This tunnel was originally equipped with overhead trolley tracks carrying bucket trains for hauling out the ashes. This equipment was torn out in 1933, the ashes from then on being handled by barrows. The exit to the tunnel is shown in Figure 18. The

Fig. 17

Two of the three batteries
of Babcox & Wilcox boilers.
Weighing mechanism for coal seen in foreground.

Fig. 18

Exit from ventilating and cleanout
tunnel. Barges in foreground.

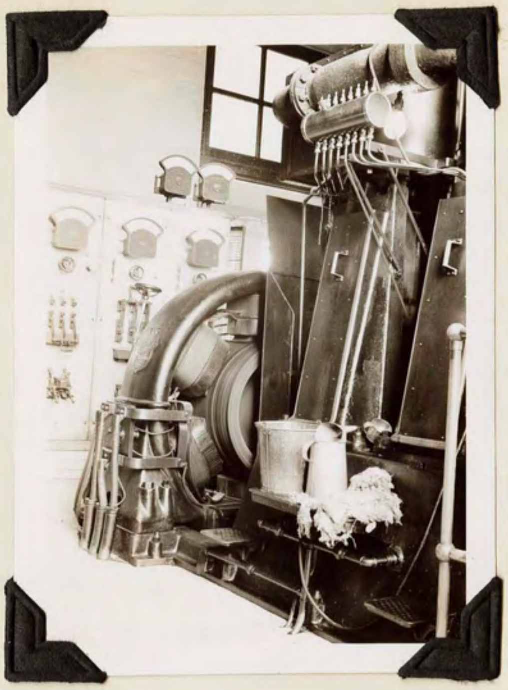

Fig. 19

One of the 220 volt D.C. generator units. Control board in background.

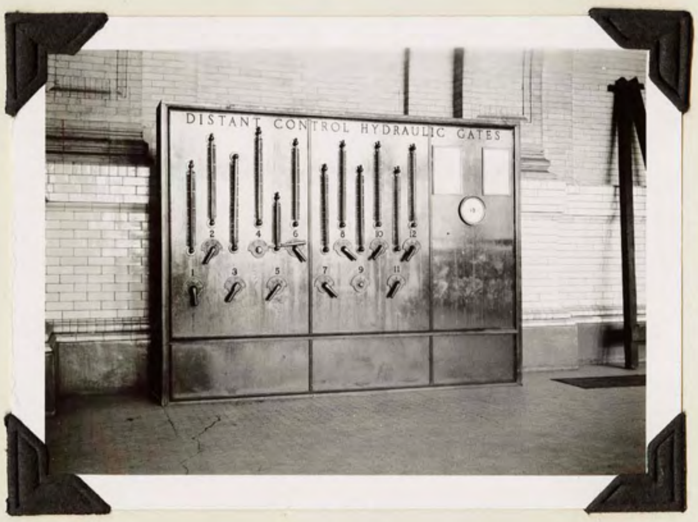

Fig. 20

Distant control board for hydraulic gates.

ashes brought out here are dumped on barges such as are seen in the foreground of the picture and are towed away to be used in roadbuilding.

MISCELLANEOUS

Electric current for general lighting, operation of the shops, and operation of the Poplar Point substation is provided by three 220 volt DC generator units operated by vertical reciprocating steam engines. One of these units is pictured in Figure 18, with the control panel showing in the background.

The station has a well-equipped machine shop, forge shop, and carpenter shop. These shops not only do the repair work for the station, but also all necessary shopwork for the sewer department, including repairs for the 12 substations. In the carpenter shop are made special forms for concrete sewer junctions, Y's, etc.

The twelve large sluice gates and valves, and the screen-raising mechanism are operated by hydraulic machinery. A booster pump raises the pressure of the city water, which is used, from around 50 psi to 140. The gates are operated by distant control from the control board situated in the engine room and illustrated in Figure 19.

Seepage into the building due to its low position relative to the river, pump leakage, and local drainage are collected in a sump from whence they are removed by a sump pump.

The sewage flow is metered by keeping records of the level

of the sewage on the suction and discharge sides. These figures will give the head on the pump, which value, along with the speed of the pump, can be plotted on the original pump curves furnished by the Allis-Chalmers Co., to find the quantity of sewage passed. The construction of the level recorders consists principally in having a float actuate a pencil axially along a drum turned by a clockwork. The wheel over which the float tape wraps actuates an ingenious device which thru a system of magnets and solenoids operates large sight dials located on the walls of the engine room. The sanitary sewage pumped has averaged recently about 115,000,000 g.p.d. More statistics on pumpage will be found near the end of the paper.

REHABILITATION

As was brought out in the section on history of the station, due to obselesence of equipment, a rehabilitation was deemed necessary. Altho the previous section on construction and operation is written in the present tense, installation and construction of the new equipment started July 28, 1937, and at the time of writing, the station is in a process of metamorphosis.

The new equipment is to be entirely electrically operated. Current will be bought from the Potomac Electric Power Co. and brought to the station at 13,200 volts. The current will be reduced to 2300 volts thru six 500 kva transformers mounted outside. The foundations for this transformer station is shown in Figure 21. The current will then be brought to an indoor trans-

Fig. 21

Mountings for new transformer station stepping down 13,200 v. Pepco. current to 2300.

Fig. 22

Mounting for new motor to operate storm water pump. (80 million g.p.d. capacity)

former vault where it will be distributed to the motors, and where some of it will be reduced to 220 and 110 for lighting and minor purposes. There is a total of 6535 watts lost thru the transformers.

All old equipment, including the boilers, engines, and pumps, is to be scrapped. The new synchronous, 3-phase, 60 cycle motors will be mounted over the same positions the engines now occupy. The original foundations are to be used, but additional beams must be placed to support the motors. The completed foundation ready for mounting of the motor is shown in Figure 22. The motors will rest in a vertical position and be directly connected to the new pumps below. The pumps have increased capacity. On the sanitary side will be one 100 million g.p.d. pump, one 80 million, and two 60 million. The storm water pumps will number six at 80 million g.p.d., the capacity of each.

Specifications on the motors for operating these pumps follow:

Make: Electric Machinery Mfg. Co.
Type: Synchronous, separately excited, full voltage starting, 3-phase, 60 cycle, 2300 volt, power factor: 1, temp. rise: 40 deg. C.

Number	Pump Capy. millions of g.p.d.	HP	Speed rpm	Volts	Diameter inches	Cost $
1	100	450	200	2300	96	7590
1	80	350	212	2300	96	8467
2	60	300	277	2300	75	11000
6	80	3000	327	2300	75	28590
						55647

The motors will be separately excited by three 125 volt, 25 kw. exciters sets running at 1200 rpm. The exciter will be

driven by 220 v. -40 HP induction motors. As a reserve, there is to be one exciter driven by a 40 HP 4 cyl. gasoline engine.

In case of failure of electric power, current will be supplied by a 485 kw. Diesel alternator to be installed where the boilers now are. The engine is an 8 cylinder, 700 HP Winton operating at 365 rpm. The 485 kw. supplied will be sufficient to operate two of the small pumps.

The motors ordinarily will be operated by automatic float switches, but they may also be operated by hand. They are protected from overload by heat-sensitive relays and alarms.

The shaft between the motor and pump is mounted on a Kingsbury thrust bearing in the motor taking about 10,000 lbs. live load, and two guide bearings. These are lubricated by oil baths.

PUMPS:

The new pumps are manufactured by the Worthington Pump and Machinery Co. They are vertical volute, centrifugal pumps with a smaller diameter and larger impeller than the old pump. For example, the 100 million gpd pump is about 9' in diameter as compared with 16 or 17' for the old 65 million gpd pump. It has a 50" suction opening and 54" discharge. Some figures on these pumps follow:

Duty	Capy. mil. gpd	Ordinary Head	Maximum Head	Cost
Sanitary	100	19	27	19,800
"	80	19	27	17,600
"	60	21	27	27,700 (for two)
"	60	21	31	
Storm	80	9	20	88,900 (for six)
				154,000

PATH OF SEWAGE

The course of the sanitary sewage thru the plant will undergo only one change in the rehabilitation. This will be in the screening. The sediment basin will be omitted. A concrete wall as shown in Figure 6 will divert the water coming thru the main sluice gates and send it to the new screens.

These screens, one of which is shown in Figure 23, are fixed. The matter gathered on them will be collected by the travelling rake shown in the foreground in the picture. The rake will travel down in front of the screen, and back up meshing with the screen. The refuse collected will be dropped into an endless belt at the top of the screen as shown in Figure 24. This belt will carry the material to a grinder situated in the foreground of Figure 24, which will macerate the material and feed it back to the sewage. It will later be removed at Blue Plains Treatment Plant. The old screen will of course be removed. From here on the course of the sewage will remain as before. The course of the storm water will not be affected.

New recording apparatus will be installed which will be more accurate and entail less calculation.

Heat for the building will be supplied by two new oil-burning 70 HP boilers installed expressly for this purpose.

While the construction is taking place, sewage is being handled by the old storm water pumps and is being discharged directly into the Anacostia River. The Low Area sewage is being pumped by three portable 4-cylinder diaphragm pumps set up in a temporary shed in the street, running 24 hours a day.

With the installation of this new equipment, the plant will

Fig. 23

New fixed type screen.
Revolving rake in the
foreground.

Fig. 24

Top of fixed screen is seen in
background. Endless belt carries
collected matter to grinding mach-
ine in foreground.

be capable of handling efficiently and economically the total sewage of a city far larger than Washington is at present. With the present rapid rise in population, due principally, as eighty years before, to ever-increasing governmental activity, it is well that this provision for the future is being made.

STATISTICS

In addition to those statistics given before, a few others might be of interest, and are included here:

Total capacity	Sanitary	Storm
Old	215,000,000 gpd	520,000,000 gpd
New	300,000,000 gpd	480,000,000 gpd

Flow figures for 1926:

Average sewage: 68,000,000 gpd

Average storm: 6,000,000 gpd or 30,000,000,000 gal. per year

Total: 74,000,000 gpd

Average cost: $0.0042 per 1000 gals.

Flow in 1937:

Average sewage: 115,000,000 gpd

Flow in Potomac River: 7,200,000,000 gpd

Total cost of station (1905-1908): $1,217,000

Total cost of rehabilitation: $567,766

On the average, two pumps are run from 8:00 a. m. to midnite, and one pump from midnite to 8:00 a. m.

The Low Area pump runs about one hour a day, pumping around 25,000 gallons.

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(Especial mention should be made of the first booklet mentioned above, from which a great deal of information was obtained, and from which the diagrams were cut.)

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